species. Probably the larger size mentioned is the fully-developed form, although by no means the most plentiful. The bihamate is also peculiar, and so difficult to find from its fineness and scarcity that I do not place much dependence on the form and size given of it; hence consider that what I have stated requires confirmation. Possibly in some parts of the specimens which have not come under my observation the flesh-spicules may be larger, more marked, and more plentiful; but after a prolonged search I have not been able to find them. The skeletal spicule, as in most other species, varies in the form of the head, being in one part simply acuate and in another more or less inflated (fig. 17, *a*, *b*). The specimens, according to the label, were obtained by Dr. Cunningham, after whom the species is named, and found at the places mentioned. They are all in the British Museum, and, besides my running no. 441, bear the register nos. 68. 6. 29. 22 and 72. 4. 19. 3 respectively. Mr. Stuart Ridley has alluded to them (Proc. Zool. Soc. 1881, p. 117, pl. x. fig. 5) for comparison with his *Esperia magellanica*, the spiculation of which is of the common type.

Although *Esperia Cunninghami* is the only species in which I have found the "inequianchorate" to present the peculiar character above mentioned, there is another in which the *bihamate* equally possesses one; and that is the *serrated* form in *Esperia serratohamata*, found among the Gulf-of-Manaar specimens from Ceylon ('Annals,' 1880, vol. vi. p. 49, pl. v. fig. 20, *b*).

[To be continued.]

XXX.—*Report on the Nematodes in the Possession of the British Museum, with a Review of the Classification of the Order.* By Dr. L. ÖRLEY.

[Plate X.]

SINCE the year 1853, in which Baird's 'Catalogue of the Species of Entozoa contained in the Collection of the British Museum' appeared, the collection has been enriched by the addition of some interesting forms, the enumeration of which will afford matter of interest to those acquainted with the group. Our knowledge of the Nematodes has undergone such changes during the last thirty years, that a fresh survey of the collection was certainly desirable. Many species reputed to be distinct are young forms of other species; and the systematic arrangement has much altered with the increase of our knowledge. To take one example:—*Ascaris incisa*, Rud., has been recognized as the young form of *Ascaris depressa*, Rud.; a large number of the species of *Ascaris* have been removed to other genera; and all the forms assigned to the genus *Agamonema*, Dies., have been discovered to be immature Ascarids. For this reason, indeed, I have put asexual forms aside, and have described, without giving specific names, those which seemed of special interest.

Although the collection of Nematodes cannot be set down as a very rich one; yet it derives value from the circumstance that a tolerably large number of genera are represented, and that it contains the original specimens of the species described by Baird and Siebold. The specimens are unfortunately, as in most other collections, not in the best state of preservation; so that a renewal of many species is very desirable. The greatest attention has, indeed, been devoted to the collection recently; but it is impossible to restore those specimens in which decomposition has already set in. Some little experience in the matter has taught me that if the worms are washed in 10-per-cent. nitric-acid solution and killed in weak alcohol, they will keep remarkably well, if they are gradually transferred to stronger spirit, and if strong spirit be added to the old alcohol every six months.

I must content myself on this occasion with simply enumerating the species in the collection, without going into the literature after the manner and with the same fulness as in Baird's Catalogue; for Linstow's Compendium* contains almost the entire bibliography, and I could at best only copy this. However, I shall take the liberty of enumerating certain species which are accidentally omitted from Linstow's Catalogue and of correcting certain errors, in order to supplement this useful book where possible†.

By the kindness of Dr. A. Günther, the Keeper of the

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* A very complete account of the literature of Entozoa is to be found in Dr. Cobbold's excellent work 'Entozoa,' &c., 1879.

† 1. *Ascaris lævissima*, Baird, 'Catalogue of the Species of Entozoa,' London, 1853, p. 25. *Hab.* India.

2. *Ascaris bifaria*, Baird, ibidem, p. 26. From the Korea.

3. *Ascaris unduloso-striata*, Baird, is introduced as *noduloso-striata*, and the host *Sarcorhamphus* is set down in the alphabetical list as *Sacorrhamphus*.

4. *Filaria gracilis*, Rud. Synops. Entoz. p. 208; Dujardin, Hist. nat. d. Helm. p. 46; Schneider, Monogr. d. Nemat. p. 87. *Hab.* In the peritoneum of *Lagothrix Humboldtii* and *Cebus capucinus*.

5. *Filaria sanguinea*, Rud. Synops. pp. 5 & 211; Dujardin, Hist. d. Helm. p. 61.

Zoological Department, I received permission to examine the collection, and was assisted in every way by Prof. Jeffrey Bell; I then exerted myself to arrange it according to the most recent system. I confess I found difficulty in deciding on which system to proceed; for, as is well known, various opinions prevail on the subject. Laying aside the old classifications of Rudolphi and Diesing, there remain the views of Bastian, Dujardin, and Schneider, and, further, those important discoveries which have been made by Leuckart and Claus on the Rhabditidæ and by Bütschli and de Man on free-living forms. I must say, at the same time, that our knowledge is, relatively, so poor with regard to the two latter groups that a monograph especially of the Rhabditidæ is much to be desired. Our acquaintance also with the general development of the Nematodes is very limited, so that we have no characters except those of the anatomy and biology by which to direct our systematic arrangement of the group.

The first question to be solved is whether the free-living should be placed with the parasitic forms, or whether the two should form independent groups.

In answer to this, different investigators have put forward different opinions. Dujardin* and Schneider† placed the free-living and parasitic forms together, while Bastian‡ considers them to be independent of each other. The two first named had but little acquaintance with the free-living forms, while the latter investigated both groups profoundly, leaving however, unfortunately, the Rhabditidæ out of consideration.

In the system of Dujardin we find all free-living forms united under the name "Enopliens," with two parasitic genera *Passalurus* and *Atractis*, a proof that they had some characters in common. When our knowledge became so immensely increased by the investigations of Bastian we came into the possession of characters which admitted of the separation of the two parasitic genera. Schneider endeavours to classify both groups by the muscular system; but Bütschli§ and other workers have sufficiently proved that by it the most closely related forms are separated.

Since Leuckart‖ and Claus¶ carried out their studies on

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* Hist. nat. d. Helm. (Paris, 1845).

† Monographie der Nematoden (Berlin, 1866).

‡ "Monograph of the Anguillulidæ," Transactions of the Linnean Society of London, vol. xxv. 1865.

§ Beitrage zur Kenntniss der freilebenden Nematoden (Dresden, 1873).

‖ Menschliche Parasiten, 1863 and 1876.

¶ Beobachtungen über die Organisation und Fortpflanzung von *Leptodera appendiculata* (Marburg, 1869).

Rhabditidæ and Rhabditoid larvæ we have become acquainted with transitional forms which appear to connect the free-living and parasitic groups. The chief of these are *Rhabditis nigrovenosa* and *appendiculata*, which show a close connexion with the parasitic genus *Oxyuris*, both from a biological and an anatomical point of view. So thoroughly does Bütschli* recognize this relationship that he considers it desirable to unite the genera *Oxyuris*, *Cephalobus*, *Anguillula*, and *Rhabditis* into one genus. I have proposed † the name Rhabditiformæ for the group. Our task, then, is to discover whether this group can be maintained in its independence, and whether the parasitic and free-living forms are to be separated, or whether a continuous chain of modifications connects all Nematodes, admitting of no lines of demarcation. We have thus come to the point at which Bastian commenced fifteen years ago; and it is to be regretted that the characters which he put forward as distinguishing the two groups from one another have not been remembered as well as they deserved.

I shall show, in the first place, that characters exist by which the so-called Rhabditiformæ may be separated from the real free-living species or Anguillulidæ.

De Man‡ was the first to demonstrate that our terrestrial and freshwater forms have been developed from three or more marine original forms; and I have assigned to that which gave rise to the Rhabditiformæ the name of "*Protoncholaimus*." From this the species of *Mononchus* and *Diplogaster* are developed. *Diplogaster* is even provided with a doubly-bulbed œsophagus, a sign that it inclines to a parasitic life; but the organs usually coincident with a free existence, such as the circumoral bristles and the lateral circular markings, are not wanting. From *Diplogaster* sprang other forms in two directions; one division has kept the bristles and lateral circular markings and acquired a caudal sucker as well (*Plectus*, Bst.), while others have entirely lost these organs, necessary to a free life; this may be taken as a sign that they have passed into a parasitic state of existence. It is just these latter species which represent the group of the Rhabditiformæ. All other free-living species known at present have at least one of the organs I have named; and many have eyes besides. Points of difference occur in the mode of reproduction and manner of life.

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* "Ueber freilebende Nematoden," Zeitschr. f. wiss. Zool. Bd. xxvi.

† Monographie der Anguilluliden: Budapest, 1880. (Editio separata e "Természetrajzi füzetek," vol. iv. partes i., ii. 1880. A musæo nationali hungarico edita.)

‡ 'Onderzoekingen over vrij in de Aarde levende Nematoden,' Leide, 1875.

The difference, on the other hand, between the free-living and truly parasitic forms is much greater; for we find distinctive characters both in the structure of the cuticle, and in that of the reproductive organs and nervous system. The cuticle of the free-living forms is tolerably thin in comparison with that of the parasites; the genital tube is simple and devoid of convolutions in the former, while in the latter the structure is complicated and there are many convolutions. In the parasitic forms the nervous system is represented exclusively by an œsophageal ring made up of nerve-fibres and nerve-cells, while in the free-living forms it is either entirely absent or consists only of a few fibres. A study of the cellular mass belonging to the nervous system (?) which surrounds the œsophagus in the free-living group discloses another important difference. On the other hand, the Rhabditiformæ stand near the free-living forms in these latter points, and are separated from the parasitic forms by the same characters; though, at the same time, the parasitic stage of *Rhabditis nigrovenosa* approaches the parasites in many points. *Oxyuris* is not to be joined to the Rhabditiformæ; for it has higher structural relations.

Differences are to be detected which perhaps may connect the simplest with the most complicated metamorphosis. In the first place, every Nematode has a larval stage; in this stage all are alike, and all, with few exceptions, lead a free existence, a proof that the parasitic are derived from the free-living forms. But while the parasitic larvæ must of necessity perish if they are unable by any means to reach the interior of other animals, the free-living forms develop into sexually mature worms without changing their abode. But how is it with the Rhabditiformæ? Schneider's investigations have already shown us that most Rhabditidæ require for their development soil or liquid which has become foul; and later experiments appear to establish the conclusion that the development of the Rhabditidæ is carried out in the midst of decomposing matter. *Rhabditis nigrovenosa* and *appendiculata* also require a nidus of filth for their later developmental stages, but have the power of developing into the sexually mature condition in this position, while their nearest allies, the Oxyurids, can only develop within the bodies of other animals. And this development into the sexual state apart from a host characterizes both free-livers and the Rhabditiformæ, while the contrary is the distinguishing mark of the parasites. If we study those Rhabditiformæ which are found in the interior of man and the higher animals, we find, from the researches of various investigators, that these species reach the mature condition just as well out of the body as within it, and that their development is not in the least influenced by the latter position. This rule applies with greater or less accuracy to the other genera which are grouped with Rhabditiformæ. *Anguillula aceti*, it is true, lives in artificially prepared vinegar, but only in the larval state, while it develops sexually and reproduces only in fermented vinegar.

Most of the *Cephalobi* live in roots of moss which have more or less undergone decay; and most Rhabditidæ live in decomposing organic matter, or in earth which contains it. We see, then, that it is just as much a necessity for the Rhabditiformæ to find a resting-place in decomposing matter as it is for the parasitic forms to reach by some means the inside of an animal; while the free-living forms, unfettered by such requirements, develop directly under most varied and independent external conditions. The preservation of the species is effected in different ways; for while the parasites secure this end by producing enormous quantities of ova, with the Rhabditidæ, which produce but few eggs, it is managed by the constant aggregation of the individuals in large numbers and by their extremely rapid development, which occupies sometimes only twenty-four hours; while their tenacity of life and their habit of wandering gives them the power of becoming widely distributed. Some Rhabditiformæ, indeed, appear to occur singly; but this cannot be decided for certain, owing to the imperfect extent to which their habits are known: in cases where isolated individuals are found it is always possible that they may be merely stray members of a colony. It is seldom that the free-living forms live together; they are generally (with the exception of the parasitic *Tylenchi*) to be found singly; they lay very few eggs; and hence the different species are always found to be feebly represented. *Diplogaster rivalis* may be mentioned here as showing a transition to the Rhabditiformæ; for it usually occurs in large numbers in wet ditches among Algæ, and also reproduces, as I have often convinced myself, with great rapidity in decayed Algæ.

Bütschli was the first who endeavoured to unite the genera *Oxyuris*, *Rhabditis*, *Cephalobus*, and *Anguillula*, on account of their agreement in the structure of the caudal termination in males &c.; these genera would seem to be closely allied. De Man has placed them in the family "Odontosphæridæ;" I have called the family Rhabditidæ. De Man associated with them the Plectidæ and Diplogasteridæ; but although I cannot deny the close affinity of these forms with the above-mentioned genera, yet they possess so many of the characters requisite to a free existence that we are justified in separating them from the Rhabditiformæ, at least until more exact study shall show other limits to be necessary for the group.

Now the Rhabditiformæ lack all the chief points usually coincident with a free life—namely, the circumoral bristles, lateral circular markings, and caudal sucker. Those structures which have been pointed out in some Rhabditidæ as short bristles around the mouth are rather to be described as long pointed papillæ, and occur in some other parasitic forms as well. Almost all Rhabditidæ possess an œsophagus with either two roundish swellings or one elongated anterior dilatation, and with a terminal bulb provided with a valvular apparatus. An œsophagus of this kind is found elsewhere only in the genera most nearly akin to them (*Plectus*, *Diplogaster*), and in the representatives of the genus *Tylenchus* (the parasite of plants)—a proof that the passage to a parasitic mode of life is marked by a modification of this kind in the structure of the œsophagus. The *Tylenchi*, however, in their other characters are very nearly related to the Rhabditiformæ, inasmuch as the above-mentioned characters are wanting in them; and I hope the time may come when a closer examination will allow us to place them with the Rhabditiformæ as a distinct genus.

Summing up what has been said, we find that there are perhaps few orders in which so continuous a series of forms exists as in the Nematodes. But that it is possible to separate by a transitional group the two divisions distinguished by Bastian I have now endeavoured to show; and even if I have carried out this separation imperfectly, I should still have for consolation the expectation that the careful researches of Leuckart, Claus, Bütschli, and De Man will yet enable us to establish more satisfactory boundary lines.

Although the complete chain of forms is not known to us, and although our present knowledge allows us only tentatively to fix boundaries to the groups, I take the liberty of proposing the following three suborders as those which best represent our knowledge up to the present time.

I. *Nematentozoa.*—Thread-worms completing their early stage in the free condition, their maturity as parasites in the bodies of the higher or the lower animals; the species being perpetuated by the production of immense numbers of ova, whose development is more or less complicated. The cuticle is fairly thick, the mouth provided with papillæ and lips; the buccal cavity and the male caudal end may be either simple or complex. The nervous system consists of distinct nerve-cells and fibres, surrounds the œsophagus, and is always well developed. The genital tube is complicated by many convolutions.

II. *Rhabditiformæ.*—Small, chiefly microscopic thread-worms, which live generally free, but in exceptional cases as parasites, and have without exception the power of developing to the sexually mature state in organic substances in a state of decomposition, or in earth saturated with such substances, such condition being necessary to the process. The species is perpetuated not so much by the production of an immense number of ova as by the habit which they have of living in colonies, of developing with great rapidity, and with a metamorphosis which is either slight or complicated by dimorphism of the sexes. They are devoid of all the principal characters usually coincident with a free life, such as circumoral bristles, caudal suckers, and lateral circular markings. The cuticle is tolerably thin; the nervous system consists more of fibres than cells, and is feebly developed and often wholly wanting. The œsophagus has two dilatations, the posterior of which is provided with a valvular apparatus. The genital tube is of simple structure, not convoluted. The mouth has lips or papillæ; the buccal cavity is usually very simple.

III. *Anguillulidæ.*—Small microscopic thread-worms leading a free existence in mould or in water throughout all their stages, developing without a complex metamorphosis. Though small, they produce large eggs. Provided with the organs belonging to a free life, such as bristles, caudal sucker, and lateral circular markings, and even with eyes in many cases. Buccal cavity simple or complex, according to the conditions under which they live. The nervous system is either entirely absent or composed only of a few fibres. Genital tube simple; no convolutions.

The Nematodes of the British-Museum collection belong to the Nematentozoa, with the exception of two species which belong to the group Rhabditiformæ; the Anguillulidæ are not represented. With regard to the first group, I must distinctly lay down that not one of the existing classifications represents the true relationships, and we shall certainly have long to wait for a natural arrangement. Of all those which have been proposed I have found that of Schneider to be the best; and although we have found the arrangement according to the muscular system not to be thoroughly satisfactory, I have adopted it provisionally. For this reason, this group includes all the genera contained in Schneider's monograph, with the exception of *Enoplus*, *Pelodera*, *Leptodera*, *Anguillula*, *Mermis*, and *Gordius*; and it is divisible into the subordinate groups, Polymyarii, Meromyarii, and Holomyarii.

For the Polymyarii Schneider enumerates ten genera, of which *Enoplus* is not to be regarded as rightly placed among them, and the genus *Ceratospira* is not represented in the collection. On the other hand, I add to the group the genus *Spiroptera*, lately characterized by Linstow, and the genus *Agamonema* as an appendix, which contains young forms of *Ascaris*, and probably of other genera. For this reason *Agamonema* is not, strictly speaking, a genus at all, but merely a collector's name for various young stages of Nematentozoa. Thus we have ten genera of Polymyarii represented in the collection.

A. **Polymyarii**, Schn.

I. Genus Ascaris, Rud.

Mouth provided with two lips; two spicula of similar form; præanal papillæ to the number of twenty and upwards.

The species are arranged according to the systematic positions of the hosts.

No.	Species.	Species of host.
1.	lumbricoides, *Lin.*	Homo sapiens[*].
	,, ,,	Troglodytes niger.
	,, (=suilla, *Duj.*).	Sus scrofa.
2.	incisa, *Rud.*[†]	Talpa europæa.
3.	mystax, *Schrank.*	Leopardus varius.
	,, ,,	Felis domestica.
	,, ,,	No locality.
3 *a.*	,, var. triquetra.	Canis vulpes.
	,, ,,	No locality.
3 *b.*	,, var. marginata.	Canis familiaris.
	,, ,,	,, aureus.
3 *c.*	,, var. leptoptera.	Felis leo.
	,, ,,	Felis concolor.
3 *d.*	,, var. microptera.	Canis lupus.
4.	transfuga, *Rud.*	Ursus arctos.s
5.	bicolor, *Baird.*	Trichechus romarus.
	,, (?)	No locality.
6.	osculata, *Rud.*	Phoca vitulina.
	,, ,,	,, grœnlandica.
	,, ,,	,, barbata.
	,, ,,	,, annulosa.
	,, ,,	Monachus albiventer.
7.	similis, *Baird.*	Phoca[‡].
8.	megalocephala, *Clogn.*	Equus caballus.
9.	Halicores, *Owen.*	Halicore cetacea.

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[*] Specimens of different races.

[†] Has been considered the young stage of *A. depressa*, Rud.

[‡] From Arctartic region.

No.	Species.	Species of host.
10.	simplex, *Rud.*	Phocæna communis.
11.	ensicaudata, *Rud.*	Turdus iliacus.
	,, ,,	,, musicus.
12.	spiralis, *Rud.*	Strix flammea.
13.	unduloso-striata.	Sarcorhamphus papa.
14.	depressa, *Rud.*	Gyps fulvus.
15.	Salvini, *Baird.*	Oreophasis Derbyana.
16.	semiteres, *Rud.*	Vanellus cristatus.
17.	serpentulus, *Rud.*	Ardea cinerea.
18.	microcephala, *Rud.*	,,
19.	spiculigera, *Rud.*	Carbo cormoranus.
	,, ,,	Mergus serratus.
	,, ,,	Colymbus septentrionalis.
	,, ,,	Pelecanus ?
20.	holoptera, *Rud.*	Testudo mauritanica.
	,, ,,	,, græca.
21.	sulcata, *Rud.*	,, geometrica.
	,, ,,	,, mauritanica.
	,, ,,	,, græca.
22.	tenuicollis, *Rud.*	Alligator fissiceps.
23.	cephaloptera, *Rud.*	Tropidonotus fasciatus.
	,, ,,	Clotho arietans.
24.	radiosa, *Schn.* (?).	,, rhinoceros.
25.	anoura, *Duj.*	Python molurus.
	,, ,,	Coryphodon pantherinus.
	,, ,,	Coluber corais.
26.	obconica, *Baird.*	Uranops angulatus.
27.	Boddaertii, *Baird.*	Herpetodryas Boddaertii.
28.	truncatula, *Rud.*	Perca cernua.
29.	dentata, *Rud.*	Mullus barbatus.
30.	constricta, *Rud.*	Cottus scorpius.
	,, ,,	Sciæna aquila.
31.	rigida, *Schn.*	Lophius piscatorius.
32.	acuta, *Rud.*	Blennius viviparus.
33.	clavata, *Rud.**	Gadus morrhua.
34.	capsularia, *R.*	,,
	,, ,,	Aphanopus carbo.
	,, ,,	No locality.
35.	mucronata, *Schr.*	Gadus cotta.
36.	collaris, *Rud.*	Platessa flesus.
37.	labiata, *Rud.*	Alepocephalus rostratus.
	,, ,,	Muræna anguilla.
38.	rotundata, *Rud.*	Raia†.
39.	meleagrina, *Kollar.*	Pearl-oyster.
40.	bifaria, *Baird.*	No locality.
41.	lævissima, *Baird.*	,, ,,

* Has been regarded as young stages of different Ascarids.

† From Madeira.

II. Genus EUSTRONGYLUS, Dies.

Mouth without lips; mouth-opening circular, surrounded by papillæ. Bursa cup-shaped. One spiculum at the tail-end of the male.

Eustrongylus gigas is the only representative of the genus in this collection. Male and female examples occur from *Sus scrofa* (domestic).

III. Genus PHYSALOPTERA, Rud.

Mouth surrounded by two semicircular lips; two spicula, differing in form; a dilated heart-shaped bursa investing the caudal termination. One unpaired papilla in front of, and ten pairs of constant papillæ behind, the anus.

No.	Species.	Species of host.
1.	saginata, *Rud.*	Tityra leuconotus.
2.	alata, *Rud.*	Falco tinnunculus.
3.	megalomastoma, *Rud.*	,, nisus.
4.	sp.? *Sieb.*	Emys venusta.
5.	obtusissima, *Molin.*	Oxyrrhopus plumbeus.
6.	retusa, *Rud.*	From a large *Tropidolepidura.*

IV. Genus HETERAKIS, Duj.

Mouth trilabiate; lips sometimes so small as to be inconspicuous; two dissimilar spicula; male with sucker in front of anus; three constant præanal papillæ and several postanal ones.

No.	Species.	Species of host.
1.	maculosa, *Rud.*	Columba domestica.
2.	inflexa*, *Rud.*	Tetrao urogallus.
	,, ,,	Gallus gallinaceus.
3.	vesicularis, *Rud.*	Pavo cristatus.
4.	faveolata, *Rud.*	Platessa flesus.

V. Genus FILARIA, Müller.

Filaria, Rud.
Spiroptera, Rud. (in part).
Lyorhynchus, Rud.

Mouth-parts showing the greatest variety in form; two dissimilar spicula; four præanal papillæ.

I here describe two new species, and point out one young form.

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* *Ascaris inflexa*, Rud.

Filaria spiralis, n. sp. (Pl. X. fig. 2, *a*, *b*.)

Female: length 1·1 millim., breadth 0·46 millim.; length of the body to that of the œsoph. = 7 : 1; length of the body to that of the tail = 40 : 1.

Body of nearly the same breadth throughout; head compressed anteriorly, termination of tail acute. Mouth surrounded by six small lips, containing a quantity of pulp; the two lateral of these lips are somewhat larger than the four median, which, however, are provided with a tooth-like process. The lips are stout, and are so closely appressed that it is very difficult to separate them. The mouth leads into a small vestibule. The cuticle is elevated into six dermal lobes, corresponding to the lips; these are connected together and form a kind of tube over the head; they are especially characteristic of our worm; their edges are smooth, not toothed. Height of the tube 0·1 millim. The œsophagus appears to consist of a short, strongly fibrillated portion, and an opaque richly granular part, which is nearly twelve times as long. The intestine is formed of a number of rows of polyhedral cells, and is coiled in its more posterior portion. The female generative organs were incompletely developed in the specimens under examination; but the vulva was observed at the sides of the anterior end of the head. Of the ten specimens, not one was a male.

The cuticle is thrown into well-marked rings, except at the head and tail, which are smooth.

This worm was found encapsuled between the serous and muscular layers of the stomach of an Australian frog, *Heiloporus albopunctatus*? It was coiled up very much like *Trichina spiralis*; and hence its specific name. It differs in very many points from any *Filaria* which has yet been found encapsuled in the Amphibia; and I cannot identify it with any described *Filaria* or *Spiroptera*.

Filaria ecaudata, mihi (= *F. obtusa*, Rud.).
(Pl. X. fig. 1, *a*–*d*.)

Male, length 35 millim.; female 80 millim. Breadth 3 millim.; length of the body to that of the œsoph. = 20 : 1; length of the body to that of the tail = 1000 : 1.

Body of the same breadth throughout and rounded; the head and tail terminate acutely. Head rounded off, pretty broad. Mouth small, round, with six papillæ; it leads directly into the œsophagus, which is so constricted anteriorly by the connexion between the lateral lines, that it is divided into an anterior and a posterior portion. The latter passes directly, and without the intervention of a bulb, into the intestine. In the former there are the two horny structures resembling triangular teeth which have been already described by Dujardin and Schneider. The intestine is nearly straight, and is made up of a large number of cells. The rectum is an extremely fine long chitinous tube; anus quite at the tip of the tail, the orifice can only be made out with the aid of high powers. The tail is not widened out, but is rounded and has much the same form in the male and female. The coils of the ovaries are very numerous, and extend from the caudal end as far as the anterior portion of the œsophagus. A large number of ova were found in the cœlom. Vulva 0·1 millim. from the end of the head. A long and much coiled testis extends from the commencement of the intestine to the anus, and fills up the body-cavity. The seminal ducts are extremely short. Two unequal spicula. Four pairs of papillæ, at the margin of the end of the tail, around the anus; there are no papillæ behind the anus. The males appear to be more common than females.

Found in *Lamprotornis æneus*; organ not given.

I feel no doubt that this worm is identical with the *Filaria obtusa* of Rudolphi, and that it is closely allied to *F. pungens*, Schn., from which, however, it is specifically distinct, on account of the form of its tail and the absence of papillæ behind the anus of the male. The free end of the horny process in the œsophagus does not form a denticulate projection; nor is the head more pointed than the tail. Again, the anus of *F. pungens* is situated further forwards than it is in *F. ecaudata*. I have found it necessary to make a change in the specific name, in consequence of Schneider's discovery that *Spiroptera obtusa* is a *Filaria*. I have endeavoured by correct description and figures to fix the characters of this species.

Filaria, sp.? (Pl. X. fig. 3, *a* & *b*.)

Length 1·35 millim., breadth 0·5 millim.; length of the body to that of the œsoph. = 10 : 1; length of the body to that of the tail = 100 : 1.

Body tapering gradually towards either end, and terminating in a sharp tail. Mouth without lips, surrounded by six very small papillæ. A short delicate pharynx leads into the œsophagus, which is fairly muscular at its commencement and termination; it gradually passes into an oval enlargement. The intestine is straight and is constricted at some points; its wall, which is formed of a number of small polyhedral cells, is enormously thick. The anus is somewhat puffed out by elevations of the cuticle; the anus is near the tip of the tail. The cuticle is very strong and so finely ringed as to appear to be almost smooth. The two lateral areas are especially well developed, and the lateral vessels, which branch repeatedly and give off ramules in all directions, are very characteristic. The lateral vessels unite in the region of the œsophageal enlargement; the strongly chitinized efferent duct opens on the ventral side at about the middle of the œsophagus. Sexual organs still undeveloped.

In many points this worm resembles *Agamonema piscium*, Rud., a form which has indeed been found by Van Beneden in the bat; there seem, however, to be important differences. As I have as yet been only able to examine one specimen, I will not describe the species as new; on the other hand, no *Filaria* has ever yet been found under the skin of a bat; and as this was found in a very rare species from Guatemala (*Diclidurus albus*), I have thought it right to give a description of it.

No.	Species.	Species of host.
1.	medinensis, *Gmelin.*	Homo sapiens.
2.	gracilis, *Rud.*	Lagothrix Humboldtii.
	,, ,,	Ateles?
	,, ,,	Cebus capucinus.
3.	sp. ? (young stage).	Diclidurus albus.
4.	strumosa, *Rud.*	Talpa europæa.
5.	n. sp., *Sieb.**	,, ,,
6.	obtusa, *Rud.*	Mus musculus.
7.	sanguinolenta, *Rud.*	Canis familiaris.
8.	quadrispina, *Dies.*	Mustela frenata.
9.	nasicola, *Duj.*	Putorius fœtidus.
10.	strongylina, *Rud.*	Sus scrofa (domestic).
11.	megastoma, *Rud.*	Equus caballus.
12.	papillosa, *Rud.*	,, ,,
13.	microstoma, *Schn.*	,, ,,
14.	inflexocaudata, *Sieb.*	Phocæna communis.
15.	Sturni, *Pall.*	Sturnus vulgaris.
16.	ecaudata, *mihi* †.	Hirundo urbica.
	,, ,,	Lamprotornis æneus.
17.	anthuris, *Rud.*	Corvus cornix.
18.	laticeps, *Rud.*	Falco tinnunculus.
19.	leptoptera, *Rud.*	,, buteo.
20.	attenuata, *Rud.*	,, peregrinus.
	,, ,,	Corvus cornix.
21.	horrida, *Dies.*	Rhea americana.
22.	spiralis, n. sp.	Heiloporus albopunctatus ?‡.
23.	sanguinea, *Rud.*	Galaxias scriba.
	,, ,,	Osmerus eperlanus.
	,, ,,	Cyprinus erythrophthalmus.
	,, ,,	Anguilla fluviatilis.

* = *F. strumosa*, Rud.

† = *F. obtusa*, R.

‡ An Australian frog.

VI. Genus SPIROPTERA, Linstow.

Spiroptera, Rud. (in part).

Mouth-parts various in form; two dissimilar spicula; eight præanal papillæ. Bursa asymmetrical.

No.	Species.	Species of host.
1.	euryoptera, *Rud.*	Lanius minor.
2.	adunca, *Crepl.*	Larus argentatus.
3.	crassicauda, *Mehlis.*	Colymbus septentrionalis.

VII. Genus AGAMONEMA, Dies.

No constant characters can be assigned; contains young forms of Nematodes, which are chiefly to be found encysted in fishes. No good species exist; those assigned to it were established by the older investigators.

No.	Species.	Species of host.
1.	communis, *Dies.*	Labrax lupus. Aphanopus carbo. Gadus morrhua. Salmo salar.
2.	bicolor, *Dies.*	Osmerus eperlanus.
3.	capsularia, *Dies.*	Clupea alosa.
	,, ,,	Merlucius valparaiso.

VIII. Genus ANCYRACANTHUS, Dies.

Mouth-parts various in form. Mouth-opening small; two dissimilar spicula; from fifteen to twenty papillæ, arranged in a line singly or in pairs.

No.	Species.	Species of host.
1.	cystidicola, *Rud.*	Salmo fario.
2.	impar, *Rud.* (?).	,, ,,

IX. Genus HEDRURIS, Creplin.

Head with four lips; two dissimilar spicula; two præanal papillæ.

No.	Species.	Species of host.
1.	androphora, *Nitsch.*	Triton cristatus.
2.	siredonis, *Baird.*	Siredon mexicanus.

X. Genus CUCULLANUS, Müller.

The mouth traverses the entire breadth of the head in the form of a slit leading into a circular mouth-capsule; two similar spicula; seven to eight præanal papillæ.

Two species occur from two hosts.

No.	Species.	Species of host.
1.	microcephalus, *Duj.*	Emys guttata.
2.	elegans, *Zed.*	Muræna anguilla.

B. **Meromyarii**, Schn.

Of the Meromyarii Schneider enumerates ten genera, of which *Leptodera* and *Pelodera* (both = *Rhabditis*, Duj.) are not to be regarded as rightly placed among them; and *Labiduris* and *Dermatoxys* are not represented in the collection.

XI. Genus NEMATOXYS, Schn.

Mouth provided with three very small lips; two similar spicula. Body covered with many papillæ both in male and female.

Nematoxys ornatus, Duj., is the only representative of the genus in this collection, from *Rana esculenta.*

XII. Genus OXYSOMA, Schn.

Mouth provided with three lips, asymmetrical. Two similar spicula; three præanal papillæ constant.

No.	Species.	Species of host.
1.	brevicaudata, *Zed.*	Bufo variabilis.
	” ”	Anguis fragilis.
2.	acuminata, *Rud.*	Rana temporaria.

XIII. Genus OXYURIS, Rud.

Ascaris, Rud. (in part).
Passalurus, Duj.
Orolaimus, Duj.
Stychocephalus, Dies.

Lips very inconspicuous; two dissimilar spicula. Bursa present or absent.

No.	Species.	Species of host.
1.	vermicularis, *Rud.*	Homo sapiens.
2.	obvelata, *Rud.*	Mus musculus.
3.	ambigua, *Rud.*	Lepus timidus.
4.	tetraptera, *Nitz.*	Mus sylvaticus.
5.	curvula, *Rud.*	Equus caballus.

XIV. Genus ATRACTIS, Duj.

Lips inconspicuous; two dissimilar spicula; three præanal papillæ.

Atractis dactylura, Duj., is the only representative of the genus in this collection, from *Testudo græca.*

XV. Genus SPIROXIS, Schn.

Mouth provided with two lips; two dissimilar spicula of large size.

Spiroxis contorta, Schn. (?), is the only representative of the genus in this collection, from *Emys europæa.*

XVI. Genus STRONGYLUS, Rud.

Dochmius, Molin.
Ancylostomum, Dubini.
Sclerostoma, Rud.
Diaphanocephalus, Dies.

Mouth-parts various in form; buccal cavity with chitinous teeth; two similar spicula. Bursa funnel-shaped.

No.	Species.	Species of host.
1.	striatus, *Zed.*	Erinaceus europæus.
2.	trigonocephalus, *Rud.*	Canis familiaris.
3.	annulatus, *Sieb.*	,, lupus.
4.	dispar, *Dies.*	Felis concolor.
5.	clathratus, *Baird.*	Loxodonta africana.
6.	sipunculiformis, *Baird.*	Elasmodon indicus.
7.	filaria, *Rud.*	Ovis aries.
8.	micrurus, *Mehlis.*	Sus scrofa.
9.	paradoxus, *Mehlis.*	,, ,,
10.	armatus, *Rud.*	Equus caballus.
11.	tetracanthus, *Dies.*	,, ,,
12.	trachealis, *Sieb.*	Perdix cinerea.
	,, ,,	Gallus gallinaceus.
13.	nodularis, *Rud.*	Anser cinereus.
14.	mucronatus, *Baird.*	Phymatura palluma.
15.	auricularius, *Rud.*	Rana temporaria.

C. **Holomyarii**, Schn.

Of the Holomyarii Schneider enumerates eight genera, of which *Anguillula*, *Mermis*, and *Gordius* are not to be regarded as rightly placed among them, and two genera are not represented in this collection; on the other hand, I add to the group the genus *Trichodes*, lately characterized by Linstow. Thus we have four genera of Holomyarii represented in the collection.

XVII. Genus TRICHOSOMA, Rud.

One spiculum; vagina protrusible.

No.	Species.	Species of host.
1.	contorta, *Creplin.*	Corvus frugilegus.
2.	resecta, *Duj.*	" "
3.	brevicollis, *Rud.*	Anser cinereus.

XVIII. Genus TRICHODES, Linstow.

Trichodes, Linstow, Troschel's Archiv, 1874, i.

No spicula; no bursa. Male in the oviducts of female during copulation.

Trichodes crassicauda, Bllg., is the only representative of the genus in this collection, from *Mus decumanus.*

XIX. Genus TRICHOCEPHALUS, Goeze.

Body hair-like at anterior and thick at posterior end. The caudal end of male screw-shaped.

No.	Species.	Species of host.
1.	dispar, *Rud.*	Homo sapiens.
2.	unguiculatus, *Rud.*	Lepus timidus.

XX. Genus PSEUDALIUS, Duj.

Two similar spicula. Bursa bilobate, spoon-shaped, or wanting. Papillæ numerous.

No.	Species.	Species of host.
1.	inflexus, *Rud.*	Phocæna communis.
2.	convolutus, *Dies.*	" "
	" "	Globiocephalus svineval.
3.	minor, *Dies.*	Phocæna communis.

RHABDITIFORMÆ.

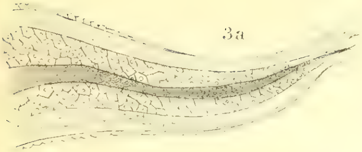
Rhabdonema nigrovenosa, Leuck. (=*Ascaris nigrovenosa,* Rud.), and *Rhabditis elongata* (=*Leptodera elongata,* Baird) are the only representatives of the suborder in this collection; the former occurs from *Rana temporaria,* the latter from *Siredon mexicanus.*

EXPLANATION OF PLATE X.

Fig. 1. *Filaria ecaudata,* mihi: *a,* head of male, mag. 70 diam.; *b,* tail of male, mag. 70 diam.; *c,* head of female, mag. 70 diam.; *d,* tail of female, mag. 70 diam.

Fig. 2. *Filaria spiralis,* n. sp.: *a,* head of female, mag. 70 diam.; *b,* tail of female, mag. 70 diam.

Fig. 3. *Filaria?* (young stage): *a,* tail, enlarged; *b,* part of the body, showing the ramifications of the lateral vessels, mag. 70 diam.



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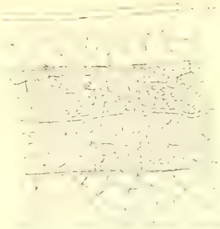

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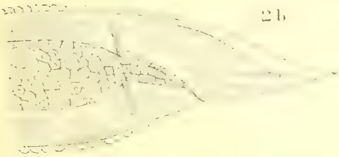

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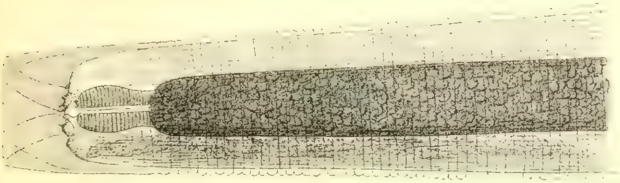

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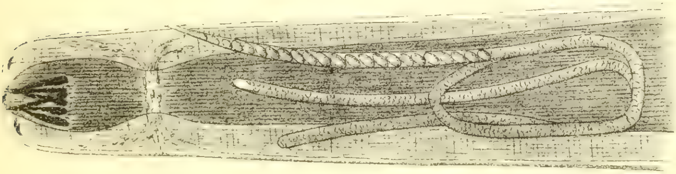

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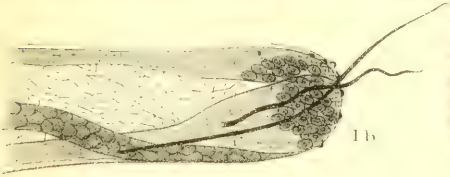

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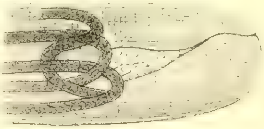

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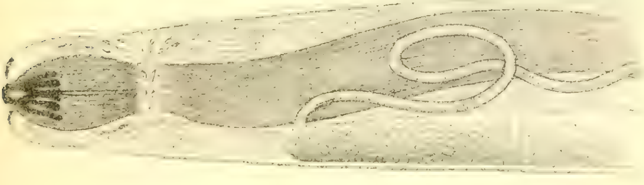

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